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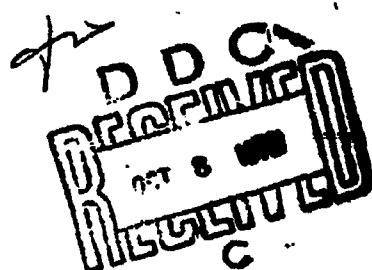
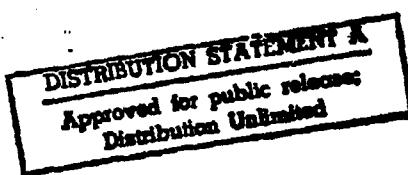
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ENVIRONMENTAL POLLUTION

by

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GS-15, DAF

A MILITARY ESSAY SUBMITTED TO THE FACULTY



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AIR WAR COLLEGE MILITARY ESSAY SUMMARY  
No. 3856

TITLE: Environmental Pollution

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The adequate disposal of waste and the purification of air and water has become a major environmental challenge. A meager amount of progress has been made in the past, but much lacks to be done by the Nation as a whole.

It is not the purpose of this paper to offer an absolute solution to all problems encountered in environmental pollution. Rather, it is an attempt to bring out some of the possible solutions that may be adopted by Government.

The problems now existing and some of the solutions in eradicating them are outlined herein and discussed.

## ENVIRONMENTAL POLLUTION

What is pollution? Coming up with a satisfactory answer is not easy. In the popular sense, pollution is any form of contamination or adulteration of water or air. The concept that land is also being polluted is gaining wider understanding and acceptance, especially with the increased attention now being paid to problems associated with solid waste handling.

These are then prime targets of the growing national concern about environmental pollution. It may be best to back off from this narrow, circumscribed view of pollution and take a broader look at the range of real and potential human problems that belong under the heading "pollution."

The basic issue is not an engineering but a legalistic one. It has to do fundamentally with the rights of the individual, or collectively the rights of the people.

Everyone has the right to breathe. But to breathe what? If the air man breathes injures his health or shortens his life, his right to breathe is infringed. Deciding when a man's health is threatened or when his life might be shortened by breathing polluted air is a complex problem that merges medical science and the law

and is certainly unclear at this time, but the existence of a basic natural right is not in doubt.

But urban congestion, too, is a kind of environmental pollution which may take the form of a freeway, a blighted residential area, or the encroachment of commercial and industrial activity into parkland or green-spaces. Clearly it is very difficult to weigh the effects of this kind of pollution against our needs for improved transportation, housing and industrial growth. Yet it is unquestionably necessary to make decisions about these kinds of environment-polluting actions to make certain that their benefits will outweigh their drawbacks.

In its broadest interpretation, then, environmental pollution can certainly include noise, economic poisons such as pesticides, and even people themselves when population density is so great as to downgrade the quality of life.<sup>1</sup>

Measuring the effect of these kinds of pollution, even determining what measurements might yield meaningful information, is a socio-scientific problem of increasing importance. But precise and continuing measurements of environmental pollution will have to be used as the basis for prudent action if mankind is to

avoid increasingly serious pollution problems. To a substantial degree, engineering skills and knowledge will be needed to develop and operate comprehensive environmental monitoring systems such as have been called for by forward-looking authorities in the pollution field. Thus, engineers, working closely with psychologists, architects, physicians, sociologists, economists, urban planners, and representatives of many other disciplines will be increasingly involved not only in the abatement and prevention of environmental pollution but also in the process of determining the nature of pollution problems and measuring their extent and severity.

Although the term environmental pollution is coming to have a very broad meaning, prime emphasis continues to center on air and water contamination and pollution of the soil by solid wastes. Not only have these problems been recognized for relatively long periods by scientists and engineers, the general public now views them as topics of great concern. They are, unlike such issues as noise and the effects of population pressure, relatively easy to identify. It takes no special gift to recognize a plume of dense smoke, a heavily polluted stream, or a rat-infested garbage dump.

Furthermore, public concern has led to action by industry and by legislative bodies from the Congress and state legislatures to town and county councils in every part of the country. Because pollution control activities undoubtedly will continue to focus primarily on contamination of the air, water, and land, this brief discussion of the place of the engineer in dealing with environmental pollution is confined to these major aspects of an admittedly much broader problem.

Both expert and popular thinking about pollution problems has tended over the past several decades to separate air pollution from water pollution and both from solid waste pollution. Although even the casual observer can readily see that a burning dump is both a source of air contamination and pollution of the land, very little effort has been made to synthesize the three aspects of the environmental pollution problem into a unified whole.

At virtually every level, from massive Federally-supported anti-pollution programs to the efforts of aroused citizen groups, the attack on pollution has been carried out under the banner, "divide and conquer." In the training of engineers, for example, the emphasis has been on developing specialists in air or water pollution

control or in solid waste management, rather than people oriented to a comprehensive approach to environmental pollution problems. Clearly, both kinds of expert are needed.

The concept that pollution of air, water, and the land is really a single problem manifested in three distinct ways did not enjoy much acceptance prior to publication in 1966 of a highly authoritative report entitled "Waste Management and Control."<sup>2</sup> The report marked a departure from conventional thinking about pollution problems by supporting the view that efforts to deal with the challenges of air, water, and land pollution can be wholly successful only if they are consolidated into a single attack on the generation and recycling of wastes.

Still largely a matter of theoretical consideration, this approach to pollution management will almost certainly gain in importance as control efforts grow in the years and decades ahead. Essentially, this unified concept implies, for example, that the reduction of water pollution by advanced treatment of municipal liquid wastes, will inevitably lead to an increase in solid or atmospheric wastes unless there is a corresponding, interrelated effort to reduce these forms of pollution.

It would appear, then, that environmental pollution presents an insoluble dilemma. Whatever we do to check one source or form of pollution only gives us the same problem in a different form.

The solution, however, according to the concept of unified waste management lies in waste recycling and utilization. If pollution is really a resource out of place, then the answer to pollution problems lies in returning these misplaced resources to a point in the system where they can be made both useful and safe.

Theoretically at least, any form of pollution--gas, solid, or liquid--can be put to beneficial use. And if practically speaking, the total mass of environmental pollutants cannot be returned to resource use, certainly a substantial portion can be recycled productively, and thus not contribute to environmental pollution problems.

Again it may be asked, what is pollution and how do we get ourselves in the kind of situation that now exists in our country? The recurring question, "Whatever happened to America the Beautiful?" reflects rising frustration over the nation's increasingly dirty air, filthy streets, and malodorous rivers. This man-made pollution, bad enough in itself, reflects something even worse: a dangerous illusion that technological man can

build bigger and bigger industrial societies with little regard for the iron laws of nature. The problem is much bigger than the United States. The whole industrialized world is getting polluted, and emerging nations are unlikely to slow their own development in the interest of clearer air and cleaner water.

Man has tended to ignore the fact that he is utterly dependent on the biosphere: a vast web of interacting processes and organisms in which one part of the living environment feeds on another. The biosphere is no immutable feature of the earth. Roughly 400 million years ago, terrestrial life consisted of primitive organisms buried in sedimentary rock, thus permitting the atmosphere to become enriched to a life-sustaining mix of 20 percent oxygen, plus nitrogen, argon, carbon dioxide, and water vapor. With miraculous precision, the mix was maintained by plants, animals and bacteria, which used and returned the gases at equal rates.<sup>3</sup>

Primitive man did the environment very little damage. But today's technological man, master of the atom and soon of the moon, is so aware of his strength that he is unaware of his weakness--the fact that his pressure on nature may provoke revenge. Many scholars are now

seriously concerned that human pollution may trigger some ecological disaster.

The fantastic effluence of affluence tends to overwhelm natural decay--the vital process that balances life in the natural world. All living things produce toxic wastes, including their own corpses. But whereas nature efficiently decays--and thus reuses--such wastes, man produces huge quantities of synthetic materials that almost totally resist natural decay. And, more and more, this waste is poisonous to man's fellow creatures, to say nothing of himself.

For one thing, the impact of human pollutants on nature can be vastly amplified by food chains, the serial process by which weak creatures are typically eaten by stronger ones, in ascending order. The most closely studied example is the effect of crop pesticides. For example, the application of only one-half pound of DDT per acre of forest to control the spruce budworm has several times seriously damaged young salmon stock in the northwestern area of North America. Pesticides can contaminate the plankton of lakes and streams. Fish eat the DDT-tainted plankton, and the pesticide becomes concentrated in their bodies; the original dose

ultimately reaches multiple strengths in fish-eating birds, which often die or stop reproducing.

An aquatic biologist of the Department of Interior's Geologic Survey has cautioned that certain "hard" pesticides tend to accumulate in the aquatic environment, somewhat like radioactivity, and thus pose environmental problems in south Florida.<sup>4</sup>

For example, Kolipinski said that parts of the water supply of the City of Miami and Everglades National Park showed DDT measurements that exceeded 0.04 micrograms per liter. This, according to Kolipinski, is only 1,000 times less than permissible limit.

Kolipinski said it is quite apparent that DDT and other pesticide sprays are finding their way into surface waters and they may be contaminating the sub-surface water-bearing rocks that yield much drinking water.

Other hard chemicals are being dumped as by-products of industrial plants into rivers and harbors throughout the United States. Of grave concern to the Alabama Water Improvement Commission is the excessive waste products of these manufacturing plants being discharged into the rivers of Alabama, causing the water to be unsafe for human consumption and killing great amounts of wild life, including fish.<sup>5</sup>

In the polluting sense, man is the dirtiest animal, and he must learn that he can no longer afford to vent smoke casually into the sky and sewage into rivers as he did in an earlier day, when vast reserves of pure air and water easily diluted the pollutants. The earth is basically a closed system with a waste-disposal process that has limits. The winds that ventilate earth are only six miles high; toxic garbage can kill the tiny organisms that normally clean rivers. Today, industrial America is straining the limits.

One important factor is that today's "consumer" man actually consumes very little--he merely uses things. Though he burns, buries, grinds, or flushes his wastes, the material survives in some form. And technology adds to its longevity. The tin can used to rust away; now comes the immortal aluminum can, which may outlast the Pyramids.

The sheer bulk of big cities slows the cleansing winds; at the same time, rising city heat helps to create thermal inversions that can trap pollutants for days. This occurred in New York City in 1963, killing 400 people. The same conditions prevail in Los Angeles almost daily, causing untold damage to real property and creating a health hazard to human environment.

Automobiles complete the deadly picture. While U.S. chimneys belch 70,000 tons of sulfa dioxide every day, 90 million motor vehicles add 230 tons of carbon monoxide and other lethal gases. Auto exhaust fumes, containing tetraethyl lead, affect human nerves, increasing irritability and decreasing normal brain function. In the auto's 70-year history, the average American's lead content has risen an estimated 125-fold, to near maximum tolerance levels. Arctic glaciers now contain wind-wafted lead.<sup>6</sup>

By the year 2000, an estimated 90 percent of Americans will live in urban areas and drive perhaps twice as many cars as they do now. The hope is that Detroit will long since have designed exhaust-free electric or steam motors. Another hope is nuclear power to generate electricity in place of smoggy "fossil fuels." But nuclear plants emit pollution, too: not only radioactive wastes, which must be buried, but also extremely hot water that has to go somewhere and can become a serious threat to marine life.

Industry already devours water on a vast scale, e.g. 600,000 gallons to make one ton of synthetic rubber. And the resultant hot water releases the dissolved oxygen in rivers and lakes, killing the bacteria that

degrade sewage. Meanwhile, the ever-mounting sewage causes other oxygen-robbing processes. By 1980, these burdens may dangerously deplete the oxygen in all 22 U.S. river basins. The first massive warning is what happened to Lake Erie, where sewage from Detroit and other cities cut the oxygen content of most of the lake's center to almost zero, turning a once magnificently productive inland sea into a sink where life is catastrophically diminished.

The trash explosion is causing great concern as a major contributor to our pollution problems. A housewife clears and washes the dinner dishes, then carries the trash can outside for an early pickup the following morning by the garbage truck. A secretary pauses in her typing, scowls at a mistake in a letter dictated by her boss and stuffs it into the waste basket. A restaurant employee strains under a heavy load of empty bottles and cans he is carrying outside the rear door into the alley.

Most people give little if any thought to such commonplace everyday chores as carrying out the garbage or crumpling up a piece of paper and looping it into a waste basket. Yet it is just such simple acts, multiplied by millions, that have brought many American cities and towns to the brink of a new and growing environmental problem.

Our society is threatened with burial under the deluge of its own wastes. The problem of solid waste disposal has taken its place, along with air and water pollution, as a major environmental challenge. Despite the fact that Americans spend three billion dollars a year to have refuse collected and disposed of, many cities and towns have fallen behind. Most face a serious crisis within two to 15 years, as the natural dumping basins provided by Mother Nature fill to overflowing.

The American economy generates some six to eight pounds of waste products per person per day, about double the weight of 40 years ago. Each year we discard six million cars, 50 billion food and beverage cans, 25 billion bottles and jars, and 65 billion metal and plastic jar and can caps.<sup>7</sup>

Already, the garbage explosion dwarfs population growth. While the number of people in the United States has increased 30 percent since 1950, the amount of solid wastes to be disposed of each year has gone up 60 percent. And the outlook is for the trash pile to continue to grow. By 1980, the experts say, waste products of our affluent society are expected to triple, to about two and a half billion pounds a day.

Of what are these solid wastes composed? Garbage, is the first answer offered by most people. Then, following a brief pause, bottles and cans. It takes longer, and some head scratching, for the average person to enlarge the list much more: paper, wood and bedding; broken crockery, dirt and ashes. Don't forget dead cats and dogs, leaves and sweepings, cinders from factories, and abandoned washing machines, refrigerators and TV sets. And, increasingly, such waste products of an advanced society as radioactive materials and pathological wastes from hospitals.

To understand why the problem is being compounded, consider wastes attributable to the tremendous growth in the use of paper products and packaging of various kinds. Nearly all the food and goods the housewife buys today come in some kind of preprocessed packaged form. As a result, the refuse collected in any typical city is about half paper--and the fashion designers are adding to the clutter with paper dresses, and promising to give us entire disposable wardrobes.

Caught short by this growing deluge, most cities and towns are learning that traditional methods of disposal are proving inadequate or unacceptable. Burning rubbish in incinerators only transfers the dirt into

the air. Existing land dump areas are rapidly being filled, and neighborhood protest groups are quick to form when officials try to establish new ones. They argue, rightfully, that so-called sanitary landfills too often are sanitary in name only. Once they are allowed to deteriorate, they become breeding places for disease-carrying rats and sources of pollution of underground water supplies.

Faced with this staggering problem, city officials, sanitary engineers and researchers are beginning to take a hard look at some new approaches to alleviate the trash problem. Both federal and local governments, for their part, are beginning to realize that the trash problem, like air and water pollution, often require solutions that cut across geographical and political boundaries. It is inefficient for one town or community to spend large sums of money on modern incineration or land-filling equipment, which stands idle most of the day. Furthermore, the most forward-looking program becomes useless against the onslaught of sewage discharge or air pollution from the next door community.

Even with community cooperation, however, it becomes increasingly evident that new approaches must be found to solid waste disposal. Two of the most promising

immediate answers are new departures in the standard incineration and landfill techniques.

Engineers in Europe are testing new-type incinerators using the heat that is produced to generate power, while at the same time creating far less pollution than burning coal or oil as a power source. The idea behind this better incinerator is : ~~simple~~: use the heat of combustion to boil water, then sell the steam or let it drive turbines to produce electricity. Not only can income from this sale of electricity help offset up to nearly half the cost of operating an incinerator, but refuse power plants can keep the soot and fly ash that go up the chimney to pollute the air as low as one percent. So much a part of European waste disposal have these dual-purpose incinerators become that their locations are chosen with due regard for their nearness to the existing industries that serve as a market for the electricity produced.

Paris and Geneva are two of the major cities that put the garbage to good use this way. Officials in Munich, Germany, expect refuse to supply 10% of the city's power needs in a few years.

Some American cities are moving in the same direction. Most promising is the six-million-dollar unit

in the town of Hempstead, Long Island, which drives both a 2,500-kilowatt electric power plant and a 420,000 gallon-a-day water desalting plant.

If building better incinerators poses one answer to putting trash to work for us, the imaginative use to which landfill operations are and could be put should be obvious to all.

People who land at New York's La Guardia Airport, for example, have yesterday's refuse to thank for their safe let-down. The airport is one of the most famous of the landmarks literally built on a trash heap. A 35-foot-high levee was built along the Santa Ana River, San Bernardino County, California, made of piled-up refuse capped with concrete. One sanitary engineer planner proposes putting the eight million tons of solid waste produced annually by New York City into an offshore airport island. Not only would this scheme temporarily solve the city's colossal trash disposal problem, it would also divert noisy jet planes from crowded residential areas to over-water take-offs and landings.

In addition to such refinements to the basic methods of solid waste disposal, entirely new approaches to the problem are being thought about and tried.

The City of St. Petersburg, Florida, has constructed a composting plant which processes the refuse of about one quarter of the city's 210,000 population without generating smoke or unpleasant odors.

A load of refuse first goes through magnetic separators which remove metal objects for processing into scrap. The remaining material, mostly garbage and paper, is melted and pulverized, then passed through additional grinders and a series of cells in which it is digested by bacteria. The dark-brown, odorless material that emerges from this accelerated bacterial process, five days later, is a valuable soil conditioner, used to improve the structure of earth and its ability to hold water.

Like composting, the practice of salvaging materials could be exercised to a much greater role than now exists. Metal, paper, textiles, glass, are all considered too valuable not to attempt to salvage in countries other than the United States. These materials are plentiful in this country and can be manufactured from raw materials cheaper than from salvagable material. In the years to come, this may not be the situation. Research and development is needed in establishing cheaper methods of salvaging all usable material now

thrown away. There will come a day when the recycling of waste materials back into useful form will be necessary.

At least imaginative is a method developed by a Japanese manufacturer of using refuse as a valuable by-product. This company makes hydraulic pressure units that compress garbage and other waste materials into solid blocks. These blocks, which may be made in virtually any desired shape, are encased with a coating of asphalt, cement, vinyl or iron sheeting, which kills the bacteria present in the garbage by the denial of oxygen. Some day soon, retaining walls, skyscraper foundations and other structures may be built of man's own waste products.

Pollution control is a matter of compromise. Achieving desirable levels of environmental quality will require something less than is suggested by the advertisements which say we have to end all forms of combustion if we want "pure air." But it may well be unreasonable, on the other hand, to think that people will ever again be able to fish for trout in our many streams. Somewhere between these extremes lies the level or range of environmental quality that is consistent with our rising aspirations and capabilities.

Environmental quality goals are necessarily flexible, the function of knowledge of the effects of environmental hazards, changing control technology, and changing public attitudes. There is a definite trend toward rising, rather than lowering our sights. What might have been acceptable in terms of air pollution control a few years ago is not acceptable today. The same is true of water and solid waste pollution. We are learning more about the effects of environmental hazards on human health and welfare; we are perfecting available technology and developing new skills for control of pollution; and we are finding the public at large increasingly intolerant of kinds and levels of pollution that seemed the normal state of affairs a generation ago, or less.

Within the last five years, the Congress has enacted landmark legislation in the field of pollution control. Every state in the Nation has or will respond to this Federal action by adopting new legal authorities, establishing or greatly expanding state programs, imposing standards for the control of air and water pollution and solid waste handling. As required by the Air Quality Act of 1967, the Department of Health, Education and Welfare establishes the extent of pollutions along with related control technology information.<sup>8</sup>

The time for Air Force engineers to be spectators instead of participants in the decision-making process has passed. Indeed there was never a time when the military engineers, collectively and as individuals, could afford the luxury of inaction in the public policy aspect of environmental pollution control.

Society, drawing hopefully on the best expert knowledge and guidance, is being forced to consider--and answer--a host of very difficult questions: How clean an environment do we want? How much are we willing to pay for control. Where do we strike the balance between environmental quality goals and the cost of achieving them?

Questions such as these involve an incredible array of decisions, choices among alternatives, and assessments of risks versus benefits. The techniques of systems analysis will increasingly need to be used in charting a path through the seeming maze of conflicting courses of action.

Each of these questions, whether answered by the sophisticated methods of systems analysis or left to the social and political process unaided, involves basic questions of national purpose and policy. And each of them touches on yet another question: What

role do we want government to play in environmental pollution control?

Everyone would do well to consider how best the government, with its police powers and control of public resources, can be used to achieve desired goals of environmental pollution control. Despite the fact that the past several years has seen a tremendous rush of action at Federal, state and local levels of government, the question of the best allocation of governmental capabilities is far from being resolved once and for all.

The trend is unmistakably toward increased concentration of pollution control authority in the hands of government, particularly Federal and state government. Two factors appear to account for this trend. For one thing there was, in the past, a marked disinclination of the private sector to acknowledge the growing seriousness of environmental pollution problems and the need to control them. Industry generally argued almost exactly the other side of the case, namely that pollution at worst was a minor and necessary adjunct of our way of life and that, with limited exceptions, it did not constitute a problem demanding major governmental action.

This attitude has not prevailed and is certainly changing, particularly among the more progressive and responsible segments of industry. But while it lasted it gave rise to the second reason for the sharply increasing role of government in environmental pollution. It has been recognized that huge investments of money and other resources will be required to achieve satisfactory control of pollution, and only government has shown a willingness to allocate resources adequate to the rushing demand. Even a wholly voluntary approach to pollution management, if it were to work, would require sizeable investments by government, investments in research and manpower development, investments in environmental monitoring, and investments in demonstration projects to assess the value of new systems and processes for waste management.

But, of course, we have not succeeded in evolving a voluntary mechanism for pollution control, even though this theme has been played over and over for a long time. Pollution sources for which the private sector is responsible almost universally have been brought under some measure of control in the face of potential or actual regulatory action by government. It should be pointed out that voluntarism has not been a complete

failure and doubtless many examples of purely voluntary action to control a pollution problem can be found. But by far the greater number of instances represent the actual or impending intervention of some agency of government having the legal power to compel control of pollution.

This pattern is well established and not likely to change, except perhaps in degree. But a question that is by no means resolved pertains to the level of government that can best bring about control of environmental pollution, best in terms of reduction of pollution levels and sources, and in terms of striking a workable balance between human requirements for environmental quality and for the benefits derived from pollution activities.

Federal legislation, almost as a matter of routine, includes a statement that pollution problems should be dealt with primarily through state and local action, and existing Federal anti-pollution programs all contain a strong element of support for state and local efforts, chiefly in the form of financial and technical assistance.

But the role of the Federal government, as expressed in legislation, does not stop there. Federal water and air pollution legislation now contains the means for developing and imposing regulatory standards on the

discharge of pollution to air and water. To be sure, the mechanism involves giving the states the opportunity to set standards on their own in line with policies and principles established by responsible Federal agencies. But the Federal government has the legal power to impose control standards when and if it determines that a state has not taken action consistent with the intent of Federal law. (Comparable standard-setting authority has not yet been enacted in the solid waste field, but most observers feel that such authority will be legislated in the course of time.)

In both air and water pollution control the Federal government retains power to control interstate pollution problems, since under our system of government disputes among or between states must be acted upon at the Federal level.

It is also important to note that Federal authority for the control of pollution, with one significant exception, is confined principally to the establishment and enforcement of air and water quality standards. The exception is the motor vehicle, the only source of pollution that is subject to a uniform national standard. The debate for and against Federal establishment of uniform national standards on classes of pollution

and pollution sources has raged for several years and is by no means at an end. Although the Congress, in 1967, passed legislation allowing the states to set air pollution control standards subject to Federal approval, it is noteworthy that the legislation originally recommended to the Congress by the Administration called instead for the development of source control standards on a national basis. Granting a small but significant concession to the Administration, the Congress, in the legislation it finally enacted, directed the Department of Health, Education and Welfare to undertake a study of the feasibility of and need for uniform national air pollution control standards on stationary sources.

The functions of the Federal government in pollution control may be fairly well established by law and practice, but the degree of coordination of these efforts clearly leaves much to be desired. Perhaps the best indication of a serious lack of coordination is the fact that air and solid waste activities are primarily centered in the Department of Health, Education, and Welfare with certain research functions assigned to the Department of the Interior, while water pollution control is the province of Interior, with certain secondary responsibilities assigned to Health, Education,

and Welfare. As if this were not divisive enough, the Commerce Department, the Department of Defense, the Department of Agriculture, the Federal Power Commission, and several other departments and agencies of the Federal government are rather heavily involved in the problems of environmental pollution. Then too, the Office of the President and the National Academy of Sciences-National Research Council exert strong influence on the conduct of Federal anti-pollution programs. Although no one seems wedded to the present hydra-headed arrangement, there is too little push behind efforts to coordinate the Federal programs.

Numerous proposals have been made calling for the creation of some supra-governmental advisory group, such as a Council of Ecologic Advisors, which would be able to coordinate Federal efforts in the total field of environmental management, including pollution control. Not without merit, these proposals to date seem to lack sufficient support in the Congress, the Administration, or among influential outside groups.

If the concept of unified waste management is to gain increasing importance, it seems inevitable that the Federal government will have to devise a better arrangement for coordinating and supporting pollution control efforts than exist now.

Although Federal efforts in the pollution control field are divided among several agencies, there are some functions which the Federal establishment discharges uniformly because it is the only level of government able to do so. Technical and financial aid to state and local programs, approval of state standards, regulatory intervention when states cannot or will not act, support of massive research and development efforts and demonstration programs, and development of skilled manpower are among the activities which the government in Washington has entered in an effective and meaningful way.

Some consideration has been given to the proposal that polluters be subject to effluent charges, fees for polluting the environment. Although such a system might have an effect on pollution discharges, it would not seem to offer a very satisfactory approach toward compliance. Wealthy firms that could afford to pay effluent charges would be accordingly less inclined to

make use of pollution control technology. Less affluent organizations and small operators who could not afford to pay these charges would presumably have to invest heavily in pollution control technology, a cost that could be prohibitive. Another factor relating to effluent charges is that payment of such charges amounts to buying a license to pollute. This is hardly a logical step for a country that is trying to reduce levels of pollution in the interest of protecting the public health and welfare.

But there is another economic inducement to pollution control yet to be tried that seems worthy of very serious consideration. This is to provide incentives through the tax structure, a technique that can fit very well into the scheme of waste management. If industry were allowed very generous tax advantages on the cost of installing and operating pollution control equipment, the link between pollution control and profit making might be strong enough to induce the large expenditures in control technology that industry will have to make in the years ahead. Furthermore, since most proposals call for special tax write-offs on Federal taxes, this method of achieving compliance would be applicable nationwide, rather than on a state by state basis.

Opponents of the tax incentive proposal point out that many forms of pollution control tend to return a profit to industry in the form of valuable waste or by-products recovered rather than discarded to the environment. Critics maintain that private industry should not receive an added economic advantage for an activity that is itself profitable. A counter argument, however, runs this way: the purpose of tax incentives is to bring about control of pollution in a way that suits with the profit objective of private industry. To the extent that such tax incentives are less profitable, they are less attractive and will, therefore, be less used. Since the goal is to have them used for purposes of pollution control, then why put unnecessary obstacles in the way of that use?

At present, the country is leaning more and more toward the mechanisms of regulatory control of pollution sources, while giving lip service to the lofty ideal of voluntary action in the public interest. It may now be time to give more than lip service to this approach by seriously investigating the real possibilities for using the profit motive itself to gain better management of pollution problems.

The role of private enterprise in waste management and pollution control is, quite naturally, greatly influenced by actions taken by government at all levels. But almost without regard to what actions government takes, private industry has some responsibilities in its own interest that relate to pollution problems and their control.

In the area of management, American industry is not making adequate use of qualified experts in pollution abatement and control. Of course, industry increasingly often calls on consulting engineers to help solve and sometimes prevent specific pollution problems. This will continue, but it is no substitute for the placement of key personnel within the top management structure who can advise on a subject that is coming to have virtually as much bearing on industrial activity as sales and research and development. No segment of industry nor individual firm can afford to do without its own authority and advisor on pollution management, an individual who has not only the technical competence to evaluate engineering problems associated with pollution and come up with solutions, but also a person who is aware of legislative and public policy trends in pollution control that will affect private enterprise.

Not enough companies in this country have such persons on their senior staffs. Pollution control may be espoused by top management and resisted by the plant manager who faces the problem on a day-to-day basis, or their pollution control positions may be reversed. It is clear that this situation cannot continue if industry is to make a meaningful response to the increasing pressure for pollution control throughout the country.

It cannot fail to be recognized that industry will have to be conscious of the need to eliminate or control pollution both within industrial operations and in the use of its products by purchasers. The significance of the fact that motor vehicles have to meet air pollution control standards during many thousands of miles of use in the hands of the customer must not be overlooked. Under the Federal Clean Air Act, it is the automotive industry, not the car owner, who is initially responsible for auto vehicle pollution--though the states are called upon to inspect the devices and the owner to maintain them. Although this principle of manufacturers' responsibility is not applied to other products yet, there is no reason to doubt that it could and might be applied to packaging materials, for example. The expanding use of nonbiodegradable

plastics and metals in the packaging of goods is a well recognized contributor to the solid waste problem.

Unless industry develops adequate solutions for this and similar problems, it may be only a matter of time before legislation will be enacted requiring the imposition of solutions, solutions which may be far less satisfactory than those which industry could develop now.<sup>9</sup>

There is no question that just as technology has polluted the country, it can also depollute it. Above all, man should strive to parallel natural decay by recycling, re-using as much waste as possible. The Air Force engineer can and should exercise his ability in preventing environmental pollution problems to generate from Air Force facilities, thereby setting an example for surrounding communities to follow.

NOTES

1. "The Engineering Challenge of Pollution Control," NSPE Publication 1706, National Society of Professional Engineers, June 1968, pp. 1-3.
2. Report produced for the National Academy of Sciences-National Research Council, by a group headed by Atholstan Spilhaus.
3. "Pollution," Time, May 10, 1968, p. 10.
4. Speech by Dr. Milton C. Koliwinski, Geological Survey Water Resources Division Office, Miami, Florida, as reported in the Alabama Journal, 30 December 1968, subject, "Biologist Tells Perils of 'Hard' Pesticides," p. 7.
5. Article in the Alabama Journal entitled "Pollution Involves Varied Factors," 23 August 1968, p. 4.
6. "Pollution," Time, May 10, 1968, p. 14.
7. Victor Block, "Defusing the Great Trash Explosion," The Milk Magazine, December 1968, p. 6.
8. Article in Federal Times, "Air Control Area Defined," January 1969, p. 19.
9. "The Engineering Challenge of Pollution Control,"